

Laparoscopic resection for endoscopically unresectable colorectal polyps: analysis of 525 patients

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Abstract

Background For the management of endoscopically irretrievable polyps, several minimally invasive procedures are currently available as alternatives to conventional laparotomy. However, the high rate of malignant transformation despite initially benign histology continues to be a problem. **Methods** Within the framework of a prospective multicenter observational study, all patients with adenomatous polyps unsuitable for endoscopic removal and with benign histology were investigated. In addition to an analysis of the perioperative course and the definitive histology, the overall and disease-free survival rates of patients with malignant transformation of colorectal adenomas were also calculated.

Results A total of 525 patients (median age 65.3 years; median body mass index 25.6 kg/m²) underwent a laparoscopic resection. Conversion to laparotomy became necessary in 17 (3.2%) cases. The perioperative morbidity rate was 20.8%, and malignant transformation occurred in a total of 18.1% of the adenomatous polyps. The median number of lymph nodes removed was 12, and lymph node metastases were seen in a total of 14.8% of the patients (T1 – 4.8%, T2 – 19.4%, T3 – 25%, T4 – 100%). Estimated 5-year overall and disease-free survival rates were 92.4% and 80.6%, respectively.

Conclusions For the management of endoscopically unresectable polyps, laparoscopic resection is currently the

technique of choice. In addition to the benefits of minimally invasive surgery, in the hands of an experienced surgeon it achieves results comparable with those of open surgery. In view of the high rate of malignant transformation and the absence of unequivocal factors predictive of already present malignant transformation, an oncologically radical operation is essential. In the elderly patient presenting with comorbidities limited resection aiming to minimize surgical trauma in potentially benign disease may be considered. In such a case, however, frozen-section histology is obligatory.

Keywords Laparoscopy · Colorectal adenoma · Morbidity · Carcinoma · Survival

The introduction of the laparoscopic surgical technique represents one of the most important innovations in the field of surgery. Today, numerous interventions are routinely carried out using this minimally invasive approach. In recent years, however, the widespread use of laparoscopic procedures in patients with colorectal carcinoma has been a frequent topic of discussion. In the first place the laparoscopic resection of colorectal carcinomas is a demanding procedure with a steep learning curve that should be performed only by surgeons with years of experience and who carry out an appropriate number of such operations annually. Furthermore, initial euphoria received a damper in the form of reports of so-called port-site metastases. However, through the strict avoidance of tumor manipulation during the operation, the use of wound protection sleeves, and the prevention of gas leaks via the trocar sites, this no longer represents a specific complication of laparoscopy [1]. The top priority of the surgical management of patients with malignant disease is always

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to guarantee the oncological radicality of the operation. Numerous studies have shown that in terms of survival and recurrence rates laparoscopic techniques provide results comparable with those achievable with open surgery [1–5]. In the hands of an appropriately experienced surgeon, therefore, laparoscopic or laparoscopically assisted resection of colorectal carcinomas can be recommended as an alternative to the open procedure that offers the benefits of minimally invasive surgery while not compromising radicality—at least within the framework of prospective studies [1–3].

Colorectal adenomatous polyps are known to be premalignant lesions which, when detected during colonoscopy, should always be removed. Colonoscopic polypectomy is the generally accepted standard treatment for adenomas and other polyps, and can usually be done as an outpatient procedure. However, at certain anatomical sites in the colon, in the case of very large, sessile or broad-based polyps, and when malignancy is suspected, endoscopic removal is no longer justifiable on the grounds that in these cases endoscopic management is associated with an elevated risk of complications such as perforation of the colon or incomplete removal of the lesion. For the treatment of such a situation, surgical intervention is required. In recent years laparoscopically assisted colonoscopic removal, colonoscopically assisted laparoscopic resection, and laparoscopic resection performed as a colotomy with polypectomy or as limited or oncologically radical resection have become established as potential alternatives to laparotomy [6–8].

The purpose of the present study was to analyze the perioperative course and the final histology of patients undergoing laparoscopic resection of endoscopically irretrievable colorectal adenomas. In addition, the overall and disease-free survival of all patients with malignant transformation of colorectal adenomas and preoperative benign histology were investigated.

Materials and methods

Within the framework of a multicenter observational study covering the period from August 1995 to January 2005, a total of 5,853 patients undergoing laparoscopic operations for colorectal benign and malignant diseases were investigated. Altogether, 69 German, Austrian, and Swiss centers participated in this study initiated by the laparoscopic colorectal surgery study group (LCSSG). For the present study all those patients submitting to laparoscopic resection for adenomatous polyps in the colon or rectum that were not suitable for endoscopic removal were analyzed, and only those patients with no evidence of malignancy preoperatively were considered; those with evidence of invasive carcinoma were excluded.

Included in the study were a total of 525 patients with preoperative endoscopic and histological evidence of adenomatous polyps. Owing to the size, type, and location of the polyps, and/or an elevated risk associated with endoscopic removal, all these patients were treated by laparoscopic or laparoscopically assisted resection. Prior to the operation, the patients received comprehensive information about the planned procedure and potential risks, and all gave their written consent. All procedures were done under general anaesthesia, and all patients received perioperative antibiotic prophylaxis. After establishing the pneumoperitoneum, diagnostic laparoscopy was performed to exclude further pathology. The number and sites of the trocars varied in accordance with the planned intervention. Intraoperative colonoscopy was carried out whenever preoperative endoscopy and laparoscopy failed to localize unequivocally the polyp(s). In the majority of cases intestinal continuity was re-established by means of a handsewn or stapled extracorporeal anastomosis; when polyps were localized in the left colon or rectum, preference was given to an intracorporeal anastomosis employing double-stapling technique with a circular stapler introduced via the anus.

Demographic data, the indication for colonoscopy, preoperative histological findings, the type and extent of the operation, the operating time, and the perioperative course including complications were recorded prospectively for every patient with the aid of a multipage questionnaire containing 45 items. In the case of patients with invasive carcinoma on final pathology an additional histological questionnaire containing 40 items was completed, and the overall and disease-free survival rates calculated. For the follow-up, all those patients undergoing at least one follow-up examination were taken into account. For the statistical analysis of the data the median values were employed; for the calculation of the overall and disease-free survival, the Kaplan–Meier survival function was applied (SPSS-PC for windows 13.0; SPSS Inc., Chicago, Ill., USA).

Results

All those patients with endoscopically irretrievable adenomatous polyps but no evidence of malignant transformation who were seen within the period between August 1995 and January 2005 were included in the study. A total of 271 (51.6%) males and 254 (48.4%) females, with median age 64.8 years (range 21–91 years) and 65.6 years (range 16–92 years), respectively, underwent a laparoscopic or laparoscopically assisted resection. The median body mass index (BMI) was 25.6 kg/m² (range 10.7–47.3 kg/m²). Overall, in 40.4% of the patients the

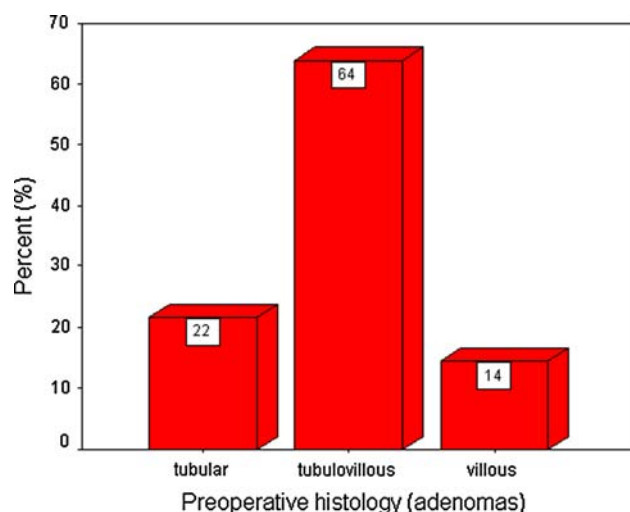


Fig. 1 Frequency (in percentage) of the individual adenoma subtypes (biopsies obtained at the preoperative endoscopy)

indication for the initial colonoscopy was perianal bleeding or positive faecal occult blood test; in 14.3% it was a change in bowel habits, and in 11.6% recurrent abdominal complaints. A total of 33.7% of the patients had no complaints and colonoscopy was done on a screening basis. The results of the histological work-up of the specimens obtained preoperatively are shown in Fig. 1, and the sites of the polyps are listed in Table 1. The most commonly performed procedures were resection of the sigmoid colon ($n = 169$; 32.2%) and rectum ($n = 126$; 24.0%). In 61 patients merely a local resection or excision (wedge resection, full-thickness excision, and segmental resection) was performed. The median operating times for the individual procedures are shown in Table 2. An oncologically radical operation with high ligation of the supplying vessels was carried out in 34.9% of the resections, and a limited lymph node dissection in 65.1%. A subanalysis of the 95 patients (18.1%) with histological evidence of malignant transformation postoperatively revealed that the procedure had been performed in compliance with oncological requirements in 65.3% of the cases. In the remaining patients the procedure took the form of a tubular lymph node dissection only.

Table 1 Anatomical locations of the endoscopically unresectable polyps

Location	Number of patients (%)
Cecum	92 (17.5)
Ascending colon	56 (10.6)
Flexure (hepatic/splenic)	35 (6.8)
Transverse colon	23 (4.4)
Sigmoid colon	187 (35.6)
Rectum	132 (25.1)

Table 2 Frequency of individual procedures and median operating times

Procedure	Number of patients (%)	Median operating time (min)
Anterior rectum resection	126 (24.0)	167
Sigmoid colon resection	169 (32.2)	160
Left hemicolectomy	7 (1.3)	160
Right hemicolectomy	88 (16.8)	150
Ileocecal resection	74 (14.1)	130
Local resection/excision	61 (11.6)	150

In the majority of the cases ($n = 483$; 92%), retrieval of the specimen was achieved via a minilaparotomy with appropriate wound protection. In 6.3% of the cases removal was effected in a retrieval bag that was recovered via a minimally enlarged trocar insertion site. In 1.7% of the patients the resected material was recovered in a retrieval bag via a retrieval trocar. Intraoperative complications were observed in a total of 17 (3.2%) patients, of whom 4 experienced bleeding or a vascular injury, and 5 perforation of the bowel. In the remaining eight patients technical problems (e.g., stapler problems) occurred. Conversion to laparotomy became necessary in 17 cases (3.2%), for the following reasons: extensive adhesions in 1.9%, haemorrhage in 0.6%, and inability to visualize the ureter in 0.7%. The median times to solid diet and bowel movement were 4 and 3 days, respectively. During the postoperative course, complications were observed in a total of 109 patients (20.8%) (Table 3). Local wound healing problems were noted in 33 patients (6.3%). These involved one or more trocar sites in 8 (1.5%) and the minilaparotomy in 25 (4.8%) cases. Of the patients with postoperative complications 25 (4.8%) required a

Table 3 Nature and frequency of the postoperative complications (more than one per patient possible)

Postoperative complications	Number of patients (%)
Overall morbidity	109 (20.8)
Bleeding requiring surgery	8 (1.5)
Postoperative ileus	20 (3.8)
Anastomotic leak	19 (3.6)
Surgical revision	8 (1.5)
Conservative treatment	11 (2.1)
Cardiopulmonary complications	23 (4.4)
Hematoma/abscess	16 (3.0)
Urinary tract infection	15 (2.9)
Sepsis	5 (1.0)
Neurological complications	3 (0.6)
Wound healing problems	33 (6.3)

reintervention (bleeding: 8; anastomotic leakage: 8; post-operative ileus: 4; intra-abdominal abscess: 2; complicated wound infection: 3 patients), while the remainder responded to conservative treatment. Of the 17 patients requiring conversion to laparotomy, 7 (41.2%) developed complications. The median overall hospital stay was 11 days (range 3–107 days) for all, and 18 days (range 7–29 days) for patients undergoing conversion to laparotomy. The perioperative mortality rate was 0.9%.

The histological work-up of the resected specimens confirmed the preoperative diagnosis of colorectal adenoma in 430 cases. Malignant transformation was observed in a total of 26 (22.8%) of the tubular, in 53 (15.8%) of the tubulovillous, and in 16 (21.1%) of the villous adenomatous polyps. This corresponds to an overall incidence of invasive growth of 18.1% [T1 (44.2%), T2 (37.9%), T3 (16.8%), T4 (1.1%)]. The carcinomas were distributed predominantly in the sigmoid colon (45, 47.4%) and rectum (27, 28.4%); 18 (18.9%) were located in the rightsided colon. Median number of lymph nodes removed was 14 (range 8–43) after radical and 11 (range 1–18) after limited (tubular) resection, respectively. Lymph node metastases were found in 14 (14.8%) patients (4.8% in T1, 19.4% in T2, 25% in T3, and 100% in T4 carcinomas). No distant metastases were found in any of the patients, either intra-operatively or by imaging. Table 4 shows the International Union against Cancer (UICC) tumor stages for all patients with polyps showing malignant transformation. Oncologically radical surgery with high ligation of the supplying vessels was performed in 10 of the 14 patients with lymph node metastases (UICC stage III) and in 13 of the 15 patients with UICC stage II (T3/T4 N–). All other patients with UICC stage II or III underwent merely tubular lymph node dissection.

Median follow-up in patients with postoperatively detected carcinoma was 2.8 years. Estimated 5-year overall and disease-free survival rates were 92.4% and 80.6%, respectively (Figs. 2 and 3). Two patients died within the follow-up period, one of advanced hepatic metastatic disease 12 months after oncologically radical resection of a rectal carcinoma (UICC stage I), the other (rectal carcinoma UICC II) 34 months after surgery with no evidence of local recurrence or distant metastatic disease. In three

Table 4 Frequency of individual tumor stages in patients with malignant transformation of adenomatous polyps and benign preoperative histology

Tumor stage	Number of patients (%)
UICC stage I	66 (69.5)
UICC stage II	15 (15.8)
UICC stage III	14 (14.7)
UICC stage IV	0 (0)

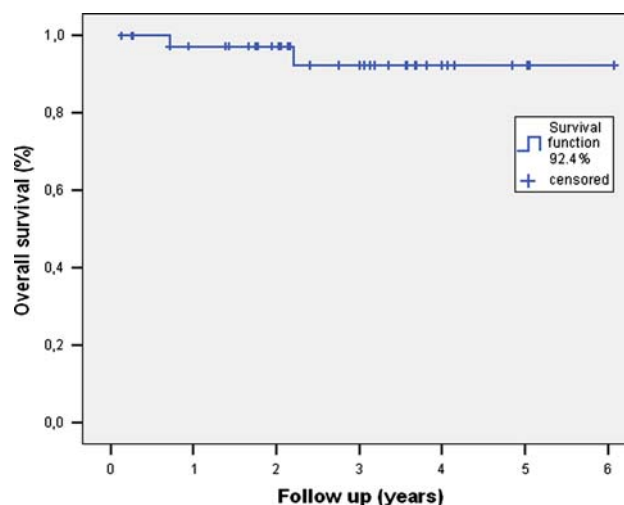


Fig. 2 Estimated 5-year overall survival (median follow-up 2.8 years)

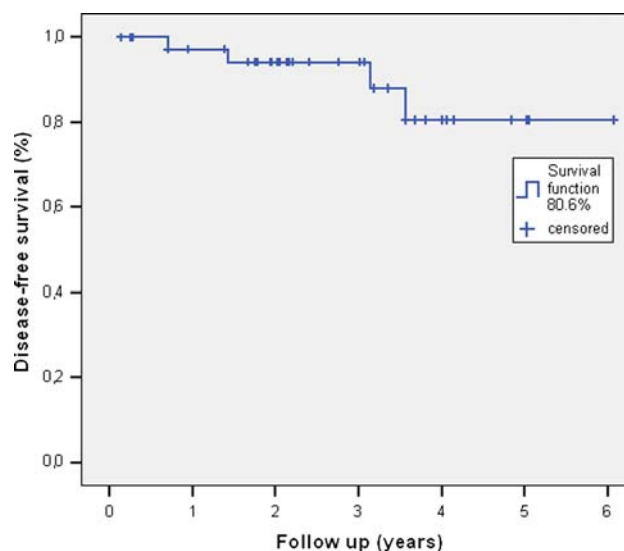


Fig. 3 Estimated 5-year disease-free survival (median follow up 2.8 years)

further patients (rectal carcinoma UICC I; sigmoid carcinoma UICC II and III) imaging revealed liver metastases 42, 36, and 10 months after laparoscopic resection. The retrospective analysis of operative radicality revealed that the patient with nodal-positive sigmoid carcinoma (UICC III) had undergone merely a tubular lymph node dissection. In none of the patients were port-site metastases observed.

Discussion

Colorectal adenomatous polyps represent a major risk factor for the development of a colorectal carcinoma. Colonoscopy is currently considered the standard

procedure for diagnosing these premalignant lesions. It enables not only a reliable biopsy to be obtained, but also, in the majority of cases, complete removal of the suspicious lesion. Although successful endoscopic removal of large polyps has been reported, sessile or broad-based lesions, very large polyps, and those located at certain sites (e.g., the ileocecal valve) are often a problem in practice [9, 10]. In addition, the risk of complications (haemorrhage, perforation) occurring during endoscopic removal is increased. In such cases, surgery is the preferred option. Laparoscopic resection in patients with colorectal disease is currently a potentially safe and effective procedure that offers all the advantages of minimally invasive management. In particular for benign colorectal diseases many years of experience with this approach have revealed outcomes comparable with, or better than, those obtained with open surgery [11, 12].

However, laparoscopic colorectal resections are still considered to challenge the skills of the surgeon. This underscores the importance of the surgeon's expertise and experience in the field of laparoscopic surgery, in particular in the case of resections for malignant colorectal disease. There was initial skepticism concerning whether adequate oncological radicality could be achieved. Furthermore, there had been individual reports of so-called port-site metastases. However, a number of recently published comparative studies have impressively shown that, in the hands of experienced surgeons operating in compliance with the requirements of oncological resections, laparoscopic procedures achieve comparable results in terms of survival and recurrence rates [1–5, 13].

With regard to the surgical management of polyps not amenable to endoscopic removal, a number of authors conclude that the laparoscopic approach may have the potential to become established as an effective and safe procedure that is less stressful for the patient [14–18]. In addition to cosmetic considerations, potential advantages over laparotomy proved to be briefer postoperative ileus together with more rapid completion of oral nutrition and return to normal bowel movement, reduced need for analgesics, fewer complications, and shorter hospital stay [14–16]. A number of authors recommend laparoscopically assisted colonoscopic polypectomy [17, 18]. In this approach the affected bowel segment is first mobilized laparoscopically, and polypectomy performed endoscopically under laparoscopic control. Any injury to the bowel that might occur can then be dealt with immediately. In particular elderly patients with comorbidities benefit from the considerable reduction in operative trauma.

The present study involving the largest group of patients so far published confirms that laparoscopic colectomy for the management of adenomatous polyps unsuitable for endoscopic removal is a safe and effective procedure. An

analysis of various parameters (completion of oral nutrition, time to first bowel movement) reveals outcomes comparable with those reported in other, much smaller studies [7, 14–16]. The 3.2% conversion rate to laparotomy was lower than that reported in comparable studies (conversion rates up to 18.4%) [14, 15, 19]. A possible explanation for this may be the different time periods in which the studies were performed. A large percentage of the patients in the present study were recruited towards the end of the 1990 s or after 2000. This was a period when laparoscopic colorectal surgery had already become established in numerous participating centers and could look back on many years of experience. A comparison of perioperative morbidity reveals a higher rate of complications (20.8%) than has been reported by other authors (15.5–17.7%) [7, 14, 19]. This may be explainable by the larger number of patients with a higher percentage of patients requiring more complicated surgery and more rectal procedures in the present study. Furthermore, the majority of the comparable studies were single-centre studies involving standardized perioperative procedures, applied by a single or a limited number of surgeons with appropriate expertise in the field of colorectal surgery. A comparison of the median hospital stay of 11 days with that reported by other authors [14–16], in particular Anglo-American authors (range 4–8 days) is in our opinion somewhat problematic on account of the specific German health insurance remuneration system (especially prior to the introduction of the diagnosis related groups (DRG) system in Germany).

The rate of malignant transformation (18.1%) of the adenomas initially diagnosed as benign, together with the number of lymph nodes removed ($n = 12$) is comparable with figures published in the literature [6, 8, 14, 16, 19, 20]. It should, however, be noted that the absolute number of lymph nodes provides no definitive information as to the quality of the lymph node dissection. Only the documentation of high ligation of the supplying vessels, together with appropriate lymph node dissection, ensures that oncological demands have been met. A critical consideration of the results of the present study makes this clear: although the absolute number of lymph nodes removed was comparable with, and in part higher than, figures reported in other studies, only 34.9% of the patients overall, and 65.3% of those with postoperative carcinomas, actually received an oncologically radical resection. One reason for the decision in favor of a limited resection might have been the advanced age of the patient. A comparison of the oncological radicality of the respective operations revealed a median age of 76.6 years for patients undergoing limited lymph node dissection compared with 61.4 years for patients undergoing an adequately oncological resection.

Apart from the high rate of malignant transformation, a relatively high percentage of lymph-node-positive or advanced carcinomas was seen (30.5%). This again emphasizes the importance of ensuring oncological radicality, since unequivocal predictive factors for identifying already existent malignant transformation of adenomatous polyps are not known. Although the likelihood of malignancy increases with increasing polyp size [21], Brozovich et al. and Ross et al. [6, 20] both failed to demonstrate any significant relationship. Nor does the preoperative detection of intraepithelial neoplasia prove to be a reliable marker for the presence of an invasive carcinoma [20].

Despite the limited lymph node dissection in 34.7% of the patients with malignant transformed adenomas in our study, no prognostic survival disadvantage was apparent (Figs. 2 and 3) with an estimated 5-year overall and disease-free survival rate of 92.4% and 80.6%, respectively. With respect to carcinomas, slightly better survival rates were seen in comparison with other studies [2, 4], presumably due to the smaller number of patients and the larger percentage of early tumor stages in our study. Further follow-up will show the extent to which the survival rates of the patients, in particular those with UICC I carcinomas, are impacted by the limited oncological radicality.

In our view, laparoscopic resection is currently the treatment of choice in the management of endoscopically unresectable polyps. In addition to the benefits of minimally invasive surgery, in the hands of an experienced surgeon it provides oncological outcomes comparable with those achieved with open surgery. However, our study, involving the largest group of patients so far investigated, confirms the high malignant transformation rate with a high percentage of locally advanced, lymph-node-positive carcinomas in patients with preoperative benign histology. On account of the absence of unequivocal predictive factors for an existing malignant transformation, an oncologically radical operation must therefore be ensured. In the individual case, irrespective of age and comorbidities, limited resection or a laparoscopically assisted colonoscopic approach to the lesion may be considered, with the aim of minimizing operative trauma. Particularly, elderly patients with comorbidities will benefit from limited resection for a potentially benign disease. In such cases, however, frozen-section histology to exclude an invasive carcinoma is obligatory. Basing the decision as to the extent of the resection solely on the size of the polyp and palpatory findings is not acceptable. If benign histology is confirmed, limited resection is justifiable. This not only minimizes operative trauma, the complication rate, and hospital stay, but also protects the elderly patient in particular from overtreatment. The limited resection option in elderly patients with comorbidities and early-stage carcinoma

(UICC I) needs to be discussed critically, and, if need be perhaps, investigated in a prospective randomized study. At the present time, however, limited resection in such cases cannot be recommended.

Finally, it must again be emphasized that laparoscopic resection of endoscopically irretrievable polyps is also a technically demanding operation that should be done by, or under the supervision of, a surgeon with many years of experience in the field of laparoscopic colorectal resection. Only in this way can the demand for oncological radicality with outcomes comparable with those achieved by conventional procedures be met by minimally invasive surgery too.

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